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ANTIMICROBIAL EFFECT OF BUFFERED SODIUM CITRATE, ALONE OR COMBINED WITH SODIUM DIACETATE, ON TOTAL AEROBIC COUNT OF GROUND BEEF STORED AT 39°F

E. Ceylan and J. L. Marsden

Summary

We studied the antimicrobial efficacy of buffered sodium citrate and a combination of buffered sodium citrate and sodium diacetate on natural aerobic microflora of ground beef stored at 39°F. For non-treated control and 1% buffered sodium citrate, total aerobic count gradually increased from 4.2 log colony forming units (CFU)/gram initially to 9.0 and 8.7 log CFU/gram, respectively, after 10 days. Both treatments reached the spoilage index number of 7.0 log CFU/gram after 5 days. A combination of 1% buffered sodium citrate and 0.1% sodium diacetate resulted in a total aerobic count of 5.9 log CFU/gram (below the spoilage index) after 10 days of storage at 39°F. Combined 1% buffered sodium citrate and 0.1% sodium diacetate suppressed growth of aerobes and increased the shelf life of ground beef stored at 39°F.

Introduction

Meat is highly perishable. Ground meat has a large surface area that favors growth of aerobic microflora during storage. Extended shelf life and greater safety of meat and poultry products are critical needs. Buffered sodium citrate is a combination of citric acid and sodium citrate. The USDA Food Safety and Inspection Service permits the use of buffered sodium citrate, effective June 24, 1996, in cured and uncured meat and poultry products. Sodium citrate, a salt of citric acid, is approved as a generally recognized safe compound by the Food and Drug Administration. It occurs as a natural compound in fruits and has few limitations for use in food.

Buffered sodium citrate (IONAL™) inhibits microbial growth and retains flavor and is especially effective when a low initial microbial count occurred. IONAL increases ionic strength in meat products and allows better water holding capacity, lower water activity, and less purge in meat and poultry products. It increases shelf life and maintains organoleptic characteristics of meat and poultry over long storage. The recommended usage level of IONAL is 1.0 to 1.3%. Its antimicrobial activity increases as pH decreases.

Fresh meats can be contaminated during handling and processing. Grinding meat increases surface area and favors the growth of microorganisms. Meat provides nutrients required for the growth of microorganisms. Intrinsic and extrinsic parameters in combinations provide a "hurdle effect" for controlling the growth of microorganisms in foods. This study evaluated the antimicrobial effect of 1% buffered sodium citrate (IONAL) alone or in combination with 0.1% sodium diacetate against natural microflora of ground beef.

Experimental Procedures

Ground beef (20% fat), purchased from a local retail store, was divided into three equal parts. The first part was designated as a control sample (no antimicrobial agents added).

The second part was mixed with 1% buffered sodium citrate, and the third with a combination of 1% buffered sodium citrate and 0.1% sodium diacetate. Samples were placed into commercial ground beef bags and stored at 39°F. Total aerobic counts were performed daily from randomly selected subsamples. These samples were homogenized and diluted using 0.1% peptone water (Difco Laboratories, Detroit, MI). Enumeration of total aerobic bacteria of samples was performed on Tryptic Soy Agar plates incubated at 95°F for 24 hours. Experiments were repeated three times.

Results and Discussion

For control and 1% IONAL treatment, the total aerobic count gradually increased from the initial level of 4.2 log CFU/gram to 9.0 and 8.7 log CFU/gram, respectively, after 10 days of storage. Both treatments reached the spoilage index number of 7.0 log CFU/gram, on the 5th day of storage. The combined 1% IONAL and 0.1% sodium diacetate resulted in a total aerobic count of 5.9 log CFU/gram, which was below the spoilage index after 10 days of storage at 39°F. The combination of 1% IONAL and 0.1% sodium diacetate suppressed the growth of total aerobic bacteria and increased the shelf life of ground beef.